The 483rd Geodynamics Seminar

Numerical studies on the flow structures of the 3-D thermal convection fluids

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Abstract

We are numerically studying a thermal convection of rotating fluid in a three-dimensional Cartesian geometry, toward the understanding of the dynamics in the liquid outer core. In this study, the numerical calculations of 13 cases have been carried out by systematically varying the values of Rayleigh number (Ra) and Ekman numbers (Ek), which are related with the magnitude of thermal buoyancy and that of Coriolis force, respectively. We confirmed the earlier finding that the three-dimensional flow structure can be classified into three patterns depending on Ra and Ek; namely, (i)the cases without the effect of rotation, (ii)the cases with moderate effect of rotation characterized by ascending and descending plumes from the thermal boundary layers which originate, (iii)the cases with strong effect of rotation where the flow structures are characterized by columnar vorticities aligned with the rotation axis. We also found that the changes in the flow structures can be identified very clearly by carefully investigating the distributions of flow velocity, temperature and vorticity in a statistical manner. In this presentation, I will show the changes in three-dimensional flow structures caused by the changes in Ra and Ek, together with the results of statistical investigation of the flows.

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